

# **AT COMMANDS and S REGISTERS**

## **REFERENCE GUIDE**

### **for**

# **CH1786, CH1787, CH1794, CH1798 and CH1799**

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**I) COMMON CONFIGURATION SETUP STRINGS**

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AT COMMAND SET REFERENCE GUIDE  
FOR CH1786, CH1794, CH1798 & CH1799

**AT Commands**

A command line is a string of characters sent from a DTE to the modem (DCE) while the modem is in a command state. A command line has a prefix, a body, and a terminator. Each command line (with the exception of the A/command) must begin with the character sequence AT and must be terminated by a

carriage return. Commands entered in upper case or lower case are accepted, but both the A and T must be of the same case, i.e., AAT@=ASCII 065, 084 or Aat@=ASCII 097, 116. The body is a string of commands restricted to printable ASCII characters (032-126). Space characters (ASCII 032) and control characters other than CR (ASCII 013) and BS (ASCII 010) in the command string are ignored. The default terminator is the ASCII <CR> character. Characters that precede the AT prefix are ignored. The command line interpretation begins upon receipt of the carriage return character.

Characters within the command line are parsed as commands with associated parameter values. The basic commands consist of single ASCII characters, or single characters preceded by a prefix character (e.g., A&@), followed by a decimal parameter. Missing decimal parameters are evaluated as 0.

The modem supports the editing of command lines by recognizing a backspace character. When modem echo is enabled, the modem responds to receipt of a backspace or delete by echoing a backspace character, a space character, and another backspace. The hex value to be used for the backspace character is programmable through register S5. Values equal to 0 or greater than 127, or the value which corresponds to the carriage return character, cannot be used for the backspace character. This editing is not applicable to the AT header of a command. A command line may be aborted at any time by entering <ctrl-x> (18h).

The AT sequence may be followed by any number of commands in sequence, except for commands such as Z, D, or A. Commands following commands Z, D, or A on the same command line will be ignored. The maximum number of characters on any command line is 39 (including AA@ and AI@). If a syntax error is found anywhere in a command line command, the remainder of the line will be ignored and the ERROR result code will be returned.

Most commands entered with parameters out of range will not be accepted and the ERROR response will be returned to the DTE.

Commands will only be accepted by the modem once the previous command has been fully executed, which is normally indicated by the return of an appropriate result code.

Execution of commands D and A, either as a result of a direct command or a re-execute command, will be aborted if another character is entered before completion of the handshake.

### **Escape Code Sequence**

When the modem has established a connection and has entered on-line data mode, it is possible to break into a data transmission in order to issue further commands to the modem in an on-line command mode. This is achieved by the DTE sending to the modem a sequence of three ASCII characters specified by register S2. The default character is >+=. The maximum time allowed between receipt of the last character of the three escape character sequence from the DTE and sending of the OK result code to the DTE is controlled by the S12 register.

### **AT Command Set**

The modem will respond to the commands detailed below. Parameters applicable to each command are listed with the command description. The defaults shown for each configuration command are those used in the Rockwell factory profile 0.

## **A) BASIC AT COMMANDS**

### **A/- Re-execute Command**

The modem behaves as though the last command line had been re-sent by the DTE. AA/@ will repeat all the commands in the command buffer.

The principal application of this command is to place another call (using the Dial command) that failed to connect due to a busy line, no answer, or a wrong number. This command must appear alone on a command line. This command should not be terminated by a carriage return.

### **AT= x - Write to Selected S-Register**

This command writes the value x to the currently selected S-Register. An S-Register can be selected by using the ATSn command. All of the S-Registers will return the OK response if x is a number. Some registers may not be written due to country specific PTT limitations.

Result Codes:

OK For all arguments.

### **AT? - Read Selected S-Register**

This command reads and displays the selected S-Register. An S-Register can be selected by using the ATSn command.

Result Codes:

OK For all arguments.

### **A - Answer**

The modem will go off-hook and attempt to answer an incoming call if correct conditions are met. Upon successful completion of answer handshake, the modem will go on-line in answer mode. This command may be affected by the state of Line Current Sense, if enabled. (Most countries do not require Line Current Sense.)

### **Bn - CCITT or Bell**

When the modem is configured to allow either option, the modem will select Bell or CCITT modulation for a line speed connection of 300 or 1200 bps according to the parameter supplied. Any other line speed will use a CCITT modulation standard. The parameter value, if valid, is written to S:17 bit 6. (Also, see ATFn command.)

B0 Selects CCITT operation at 300 or 1200 bps during Call Establishment and a subsequent connection.

B1 Selects BELL operation at 300 or 1200 bps during Call Establishment and a subsequent connection. (Default)

Result Codes:

OK n=0 or 1.

ERROR Otherwise.

### **Dn - Dial**

This command directs the modem to go on-line, dial according to the string entered and attempt to establish a connection. If no dial string is supplied, the modem will go on-line and attempt the handshake in original mode. In W-class models, the action of going off-hook is affected by the status of the Line Current Sense input, if line current sensing is enabled, and by the blacklist and delayed list. NOTE: If the ATD command is issued before the S1 register has cleared, the modem will respond with the NO CARRIER result code.

Dial Modifiers. The valid dial string parameters are described below. Punctuation characters may be used for clarity, with parentheses, hyphen, and spaces being ignored.

0-9 DTMF digits 0 to 9.

\* The >star= digit (tone dialing only).

A-D DTMF digits A, B, C and D. Some countries may prohibit sending of these digits during dialing.

L Re-dial last number: the modem will re-dial the last valid telephone number. The L must be immediately after the D with all the following characters ignored (CH1798/94 only).

P Select pulse dialing: pulse dial the numbers that follow until a AT@ is encountered. Affects current and subsequent dialing. Some countries prevent changing dialing modes after the first digit is selected.

T Select tone dialing: tone dial the numbers that follow until a AP@ is encountered. Affects current and subsequent dialing. Some countries prevent changing dialing modes after the first digit is dialed.

&Z)>

S=n Dial the number stored in the directory (n:=0 to 3). (See

value of

! Flash: the modem will go on-hook for a time defined by the

S29. Country requirements may limit the time imposed.

Wait for the dial tone: the modem will wait for dial tone before dialing the digits following "W". If dial tone is not detected within the time specified by S6, the modem will abort the rest of the sequence, return on hook, and generate an error message.

@ Wait for silence: the modem will wait for at least 5 seconds of silence in the call progress frequency band before continuing with the next dial string parameter. If the modem does not detect these 5 seconds of silence before the expiration of the call abort timer (S6), the modem will terminate the call attempt with a NO ANSWER message. If busy detection is enabled, the modem may terminate the call with the BUSY result code. If answer tone arrives during execution of this parameter, the modem handshakes.

& Wait for credit card dialing tone before continuing with the dial string. If the tone is not detected within the time specified by S7, the modem will abort the rest of the sequence, return on-hook and generate an error message (for CH1798/94 only).

, Dial pause: the modem will pause for a time specified by S8 before dialing the digits following @,@.

; Return to command state. Added to the end of a dialstring, this causes the modem to return to the command state after it processes the portion of the dial string preceding the A,@. This allows the user to issue additional AT commands while remaining off-hook. The additional

AT commands may be placed in the original command line following the A,@ and/or may be entered on subsequent command lines. The modem will enter call progress only after an additional dial command is issued without the A,@ terminator. Use AH@ to abort the dial in progress, and go back on-hook.

^ Toggles calling tone enable/disable: applicable to current dial attempt only (CH 1798/94 only).

### **En - Command Echo**

The modem enables or disables the echo of characters to the DTE according to the parameter supplied. The parameter value, if valid, is written to S14 bit 1.

E0 Disables command echo.

E1 Enables command echo. (Default)

Result Codes:

OK n=0 or 1.

ERROR Otherwise.

### **Fn - Select Line Modulation (CH1794 only)**

This command selects the line modulation according to the parameter supplied. The line modulation is fixed unless Automode is selected. This command interacts with the S37 and the N command. The parameter value, if valid, is written to S37 bits 0-4. To select line modulation, it is recommended that either the F command, or a combination of the S37 and the N command, be used, but not both.

F0 Selects auto-detect mode. Sets N1 and sets S31 bit 1. In this mode, the modem configures for automode operation. All connect speeds supported by the modem are possible according to the remote modem's preference. The contents of S37 are ignored as is the sensed DTE speed.

F1 Selects V.21 or Bell 103 according to the B setting as the only acceptable line speed resulting in a subsequent connection. Sets N0, sets S37 to 1, and clears S31 bit 1. This command is equivalent to the command string: ATN0S37=1.

F2 Not supported.

F3 Selects V.23 as the only acceptable line modulation for a subsequent connection. Originator is at 75 bps and answered is at 1200 bps. Sets N0, sets S37 to 7, and clears S31 bit 1. This command is equivalent to the command string: ATN0S37=7.

F4 Selects V.22 1200 or Bell 212A according to the B command setting as the only acceptable line speed for a subsequent connection. Sets N0, sets S37 to 5, and clears S31 bit 1. This command is equivalent to the command string: ATN0S37=5.

F5 Selects V.22 bis as the only acceptable line modulation for a subsequent connection. Sets N0, sets S37 to 6, and clears S31 bit 1. This command is equivalent to the command string: ATN0S37=6.

F6 Selects V.32 bis 4800 or V.32 4800 as the only acceptable line modulation for a subsequent connection. Sets N0, sets S37 to 8, and clears S31 bit 1. This command is equivalent to the command string: ATN0S37=8.

F7 Selects V.32 bis 7200 as the only acceptable line modulation for a subsequent connection. Sets N0, sets S37 to 12, and clears S31 bit 1. This command is equivalent to the command string: ATN0S37=12.

This setting also allows connection at the Rockwell proprietary 7200 V.32 speed, e.g., with a RC9696/12 based modem.

F8 Selects V.32 bis 9600 or V.32 9600 as the only acceptable line modulations for a subsequent connection. Sets N0, sets S37 to 9, and clears S31 bit 1. This command is equivalent to the command string: ATN0S37=9.

F9 Selects V.32 bis 12000 as the only acceptable line modulations for a subsequent connection. Sets N0, sets S37 to 10, and clears S31 bit 1. This command is equivalent to the command string: ATN0S37=10.

F10 Selects V.32 bis 14000 as the only acceptable line modulation for a subsequent connection. Sets N0, sets S37 to 11, and clears S31 bit 1. This command is equivalent to the command string: ATN0S37=11.

### **Hn - Disconnect (Hang-up)**

This command initiates a hang up sequence.

This command may not be available for some countries due to PTT restrictions.



H0 The modem will release the line if the modem is currently on-line, and will terminate any test (AT&T) that is in progress

H1 If on-hook, the modem will go off-hook and enter command mode.

Result Codes:

OK n=0 or 1.

ERROR Otherwise

### **In - Identification**

The modem reports to the DTE the requested result according to the command parameter.

10 Reports product code. Example 28800.

11 Calculates the ROM checksum and reports the least significant byte of the checksum in decimal (see firmware release notes). Reports 255 if the prestored checksum value is Ffh. Reports 194 for CH1786.

12 Calculates the ROM checksum and compares it with the prestored checksum. Reports AOK@ if the calculated checksum equals the prestored checksum or if the prestored checksum value is Ffh; otherwise reports AERROR@.

13 Reports the firmware version (F), basic model (e.g., V34), application code (A), and interface type code (I) typically in the form VF.FFF-V34\_AI. The application codes are: D=Desktop, L=Low Power (PCMCIA). The interface type codes are: S=Serial, P=Parallel. Example: V1.400-V34\_DS

Note: 14 to 17 are for CH179X only.

14 Reports OEM defined identifier string in either Hayes-compatible binary format (default) or ASCII format (selected by Configure ACE). Example: RC288ACi (ASCII)

15 Reports Country Code parameter. Example: 022

16 Reports modem data pump model and internal code revision.

Example: RC288DPi Rev 05A

17 Reports the DAA code resulting from MCU interrogation of the DAA for auto DAA recognition. Examples: 000 for US

or Canada, 016 for Japan, 033 for Belgium, 034 for Finland, 035 for France, 037 for Italy, 038 for Netherlands, 039 for Sweden, 040 for Switzerland, and 041 for UK.

Result Codes:

OK n=0 to 7.

ERROR Otherwise.

### **Ln - Speaker Volume**

The modem sets the speaker volume control according to the parameter supplied. The parameter value, if valid, is written to S22 bits 0 and 1.

L0 Low volume.

L1 Low volume. (Default for CH1798/94)

L2 Medium volume. (Default for CH1786)

L3 High volume.

Result Codes:

OK n=0 to 3.

ERROR Otherwise.

### **Mn - Speaker Control**

This command selects when the speaker will be on or off. The parameter value, if valid, is written to S22 bits 2 and 3.

M0 Speaker is always off.

M1 Speaker is on during call establishment, but off when receiving carrier. (Default.)

M2 Speaker is always on.

M3 Speaker is OFF when receiving carrier and during dialing, but ON during answering,

Result Codes:

OK n=0 to 3.

ERROR Otherwise.

### **Nn - Automode Enable (CH179X only)**

This command enables or disables automode detection. The parameter value if valid, is written to S31 bit 1.

N0 Automode detection is disabled (equivalent to setting the +MS <automode> subparameter to 0). A subsequent handshake will be conducted according to the contents of S37 or, if S37 is zero, according to the most recently sensed DTE speed.

N1 Automode detection is enables

(equivalent to setting the +MS <automode> subparameter to 1). A subsequent handshake will be conducted according the automode algorithm supported by the modem, e.g., according to the contents of S37 or, if S37 is zero, starting at 28800 bps V.34 (RC288). This command is also equivalent to F0 (RC144). (Default.)

Result Codes:

OK n=0 or 1.

ERROR Otherwise.

Notes:

1. The Nn and S37=x commands override the +MS command settings. When the N0 or N1 command is issued, the +MS subparameters are updated to reflect the Nn and S37 values (see +MS command and S37 register). For example:

N1S37=10 updates the +MS command subparameters to reflect

+MS=10-,1,300,12000

N0S37=10 updates the +MS command subparameters to reflect

+MS=10, 0, 12000,12000

1. Use of the +MS command is recommended instead of the Nn and S37=x commands. Nn and S37=x commands are supported for compatibility with existing communication software.

### **On - Return to On-Line Data Mode**

This command determines how the modem will enter the on-line data mode. If the modem is the on-line command mode, the enters the on-line data mode with or without a retrain. If the modem is in the off-line command mode (no connection), ERROR is reported.

O0 Enters on-line data mode without a retrain. Handling is determined by the Call Establishment task. Generally, if a connection exists, this command connects the DTE back to the remote modem after an escape (+++).

O1 Enters on-line data mode with a retrain before returning to on-line data mode.

Result Codes:

OK =0 or 1 and a connection exists.

ERROR Otherwise or if not connected.

### **P - Set Pulse Dial Default**

This command forces pulse dialing until the next T dial modifier or T command is received. Sets S14 bit 5.

As soon as a dial command is executed which explicitly specifies the dialing mode for that particular call (e.g., ATDT...), this command is overridden so that all future dialing will be tone dialed. (See T command.)

This command may not be permitted in some countries.

Result Code:

OK

### **Qn - Quiet Results Codes Control**

The command enables or disables the sending of result codes to the DTE according to the parameter supplied. The parameter value, if valid, is written to S14 bit 2.

Q0 Enables result codes to the DTE.  
(Default.)

Q1 Disables result codes to the DTE.

Result Codes:

OK n=0 or 1.

ERROR Otherwise.

### **Sn - Read/Write S-Register**

The modem selects an S-Register, performs an S-Register read or write function, or reports the value of an S-Register.

n Establishes S-Register n as the last register accessed.

n=v Sets S-Register n to the value v.

n? Reports the value of S-Register n.

The parameter n can be omitted, in which case the last S-Register accessed will be assumed. The S can be omitted for AT= and AT?, in which case the last S-Register accessed will be assumed.

For example:

ATS7 establishes S7 as the last accessed register.

AT=40 sets the contents of the last register accessed to 40.

ATS=20 sets the contents of the last register accessed to 20.

If the number An@ is beyond the range of the S-Registers available, the modem will return the ERROR message. Note that some S-Registers are read-only.

In some cases, writing to the S-Register will appear to be accepted but the value will not actually be written.

Due to country restrictions, some commands will be accepted, but the value may be limited and replaced by a maximum or minimum value.

### **T - Set Tone Dial Default**

This command forces DTMF dialing until the next P dial modifier or P command is

received. The modem will set an S-Register bit to indicate that all subsequent dialing should be conducted in tone mode. Note that the DP command will override this command. Clears S14 bit 5.

This command may not be permitted in some countries. (See P.)

Result Codes:

OK

#### **Vn - Result Code Form**

This command selects the sending of short-form or long-form codes to the DTE. The parameter, if valid, is written to S14 bit 3.

V0 Enables short-form (terse) result codes. Line feed is not issued before a short-form result code.

V1 Enables long-form (verbose) result codes. (Default.)

Result Codes:

OK n=0 or 1.

ERROR Otherwise.

#### **Wn - Connect Message Control (CH179X only)**

This command controls the format of CONNECT messages. The parameter value, if valid, is written to S31 bits 2 and 3. Note that the Wn command can be overridden by register S95 bits (see S95 description).

W0 Upon connection, the modem reports only the DTE speed (e.g., CONNECT 19200). Subsequent responses are disabled. (Default.)

W1 Upon connection, the modem reports the line speed, the error correction protocol, and the DTE speed, respectively. Subsequent responses are disabled.

W2 Upon connection, the modem reports the DCE speed (e.g., CONNECT 19200). Subsequent responses are disabled.

#### **Xn - Extended Result Codes:**

This command selects which subset of the result messages will be used by the modem to inform the DTE of the results of commands.

Blind dialing is enabled or disabled by country parameters. If the user wishes to enforce dial tone detection, a AW@ can be placed in the dial string (see D command). Note that the information below is based upon the default implementation of the X results table. Table 3-1 indicates the messages which are enabled for each X value.

If the modem is in facsimile mode (+FCLASS=1 or 2), the only message sent to indicate a connection is CONNECT without a speed indication.

X0 Disables monitoring of busy tones unless otherwise by country

requirements; send only OK, CONNECT, RING, NO CARRIER, ERROR, and NO ANSWER result codes. Blind dialing is enabled/ disabled by country parameters. If busy tone detection is enforced and busy tone is detected, NO CARRIER will be reported instead of NO DIAL TONE. The value 000b is written to S22 bits 6, 5, and 4, respectively (Busy signal and dial tone are not detected in CH1786.)

X1 Disables monitoring of busy tones unless forced otherwise by country requirements; send only OK, CONNECT, RING, NO CARRIER, ERROR, NO ANSWER, and CONNECT XXXX (XXXX=rate). Blind dialing enabled/disabled by country parameters. If busy tone detection is enforced and busy tone is detected, NO CARRIER will be reported instead of BUSY. If dial tone detection is enforced or selected and dial tone is not detected, NO CARRIER will be reported instead of NO DIAL TONE. The value 100b is written to S22 bits 6, 5, and 4, respectively (Busy signal and dial tone are not detected in CH1786).

X2 Disables monitoring of busy tones unless forced otherwise by country requirements; send only OK, CONNECT, RING, NO CARRIER, ERROR, NO DIAL TONE, NO ANSWER, and CONNECT XXXX. If busy tone detection is enforced and busy tone is detected, NO CARRIER will be reported instead of BUSY. If dial tone detection is enforced or selected and dial tone is not detected, NO DIAL TONE will be reported instead of NO CARRIER. The value 101b is written to S22 bits 6, 5, and 4, respectively.

X3 Enables monitoring of busy tones; send only OK, CONNECT, RING, NO CARRIER, ERROR, NO ANSWER, and CONNECT XXXX. Blind dialing is enabled/disabled by country parameters. If dial tone detection is enforced and dial tone is not detected, NO CARRIER will be reported. The value 110b is written to S22 bits, 6, 5, and 4, respectively (Dial tone is not detected in CH1786).

X4 Enables monitoring of busy tones; send all messages. The value 111b is written to S22 bits 6, 5, and 4, respectively. (Default.)

Result Codes:

OK n=0 to 4.

ERROR Otherwise.

**Table 1. Result Codes**

Short Form	Long Form	0	1	2	3	4	Notes
0	OK	x	x	x	x	x	0
1	CONNECT	x	x	x	x	x	*
2	RING	x	x	x	x	x	*
3	NO CARRIER	x	x	x	x	x	*
4	ERROR	x	x	x	x	x	*
5	CONNECT 1200	1	x	x	x	x	*
6	NO DIAL TONE	3	3	x	x	x	*
7	BUSY	3	3	3	x	x	*
8	NO ANSWER	x	x	x	x	x	*
9	CONNECT 0600	1	x	x	x	x	
10	CONNECT 2400	1	x	x	x	x	*
11	CONNECT 4800	1	x	x	x	x	
12	CONNECT 9600	1	x	x	x	x	
13	CONNECT 7200	1	x	x	x	x	
14	CONNECT 12000	1	x	x	x	x	
15	CONNECT 14400	1	x	x	x	x	
16	CONNECT 19200	1	x	x	x	x	
17	CONNECT 38400	1	x	x	x	x	
18	CONNECT 57600	1	x	x	x	x	
19	CONNECT 115200	1	x	x	x	x	
22	CONNECT 75TX/1200RX	1	x	x	x	x	
23	CONNECT 1200TX/75RX	1	x	x	x	x	
24	DELAYED	4	4	4	4	x	
32	BLACKLISTED	4	4	4	4	x	
33	FAX	x	x	x	x	x	*
35	DATA	x	x	x	x	x	*
40	CARRIER 300	x	x	x	x	x	CH1794 and up
44	CARRIER 1200/75	x	x	x	x	x	CH1794 and up
45	CARRIER 75/1200	x	x	x	x	x	CH1794 and up
46	CARRIER 1200	x	x	x	x	x	CH1794 and up
47	CARRIER 2400	x	x	x	x	x	CH1794 and up
48	CARRIER 4800	x	x	x	x	x	CH1794 and up
49	CARRIER 7200	x	x	x	x	x	CH1794 and up
50	CARRIER 9600	x	x	x	x	x	CH1794 and up
51	CARRIER 12000	x	x	x	x	x	CH1794 and up
52	CARRIER 14400	x	x	x	x	x	CH1794 and up
53	CARRIER 16800	x	x	x	x	x	CH1798 and up
54	CARRIER 19200	x	x	x	x	x	CH1798 and up
55	CARRIER 21600	x	x	x	x	x	CH1798 and up
56	CARRIER 24000	x	x	x	x	x	CH1798 and up
57	CARRIER 26400	x	x	x	x	x	CH1798 and up
58	CARRIER 28800	x	x	x	x	x	CH1798 and up
59	CONNECT 16800	1	x	x	x	x	CH1798 and up
61	CONNECT 21600	1	x	x	x	x	CH1798 and up
62	CONNECT 24000	1	x	x	x	x	CH1798 and up
63	CONNECT 26400	1	x	x	x	x	CH1798 and up
64	CONNECT 28800	1	x	x	x	x	CH1798 and up

66	COMPRESSION: CLASS 5	x	x	x	x	x	
67	COMPRESSION: V.42 bis	x	x	x	x	x	
69	COMPRESSION: NONE	x	x	x	x	x	
76	PROTOCOL: NONE	x	x	x	x	x	
77	PROTOCOL: LAPM	x	x	x	x	x	
80	PROTOCOL: ALT	x	x	x	x	x	
84	CONNECT 33600	x	x	x	x	x	CH1799 only
91	CONNECT 31200	x	x	x	x	x	CH1799 only
150	CONNECT 32000	x	x	x	x	x	CH1799 only
+F4	+FCERROR	x	x	x	x	x	

**Note:** 1. An >x= in a column indicates that the message (either the long form if verbose, or the value only for short form) will be generated when that particular value of >n= (shown at the top of the column) has been selected by the use of ATXn. If the column is blank, then no message will be generated for that x option. A numeral indicates which less explicit message (verbose or short form) will be cutput for that X option. (Also, see Section 1.3). 2.CH1786 has only the result codes marked with >\*=.

### Yn - Long Space Disconnect

This command enables/disables the generation and response to long space disconnect. The parameter value, if valid, is written to S21 bit 7.

Y0 Disables long space disconnect. (Default.)

Y1 Enables long space disconnect. In non-error correction mode, the modem will send a long space of four seconds prior to going on-hook. In non-error correction mode, the modem will respond to the receipt of a long space (i.e., a break signal greater than 1.6 seconds) by going on-hook.

Result Codes:

OK n=0 or 1.

ERROR Otherwise.

### Zn - Soft Reset and Restore Profile

The modem performs a soft reset and restores (recalls) the configuration profile according to the parameter supplied. If no parameter is specified, zero is assumed.

Z0 Soft reset and restore stored profile 0.

Z1 Soft reset and restore stored profile 1.

Result Codes:

OK n=0 or 1.

ERROR Otherwise.

## B) AT& Commands

### &Cn - RLSD (DCD) Option



The modem controls the RLSD output in accordance with the parameter supplied. The parameter value, if valid, is written to S21 bit 5 (CH1798/94 only).

&C0 RLSD remains ON at all times (Default).

&C1 RLSD follows the state of the carrier.

Result Codes:

OK n=0 or 1.

ERROR Otherwise.

### **&Dn - DTR Option**

This command interprets the ON to OFF transition of the DTR signal from the DTE in accordance with the parameter supplied. The parameter value, if valid, is written to S21 bits 3 and 4. Also, see S25.

&D0 DTR drop is interpreted according to the current &Qn setting as follows:

&Q0,  
&Q5,  
&Q6  
DTR  
is  
ignored  
(assumed  
ON).  
Allows  
operation  
with  
DTEs  
that  
do  
not  
provide  
DTR.  
  
&Q1,  
&Q4  
DTR  
drop  
causes  
the  
modem  
to  
hang  
up.  
Auto-answer  
is  
not  
affected.

&Q2, &Q3 DTR drop causes the modem to hang up. Auto-answer is inhibited.

&D1 DTR drop is  
interrupted  
according to the  
current &Qn  
setting as follows:

&Q0, &Q1, &Q4,  
  
&Q5,  
&Q6

DTR  
drop  
is  
interpreted  
by  
the  
modem  
as  
if  
the  
asynchronous  
escape  
sequence  
had  
been  
entered.  
The  
modem  
returns  
to  
asynchronous  
command  
state  
without  
disconnecting.

&Q2, &Q3 DTR  
drop causes the  
modem to  
hang-up.  
Auto-answer is  
inhibited.

&D2 DTR drop is  
interpreted  
according to the  
current &Qn  
setting as follows:

&Q0  
through  
&Q6  
DTR  
drop  
causes  
the  
modem  
to  
hang-up  
Auto-answer  
in  
inhibited.  
(Default.)

&D3 DTR drop is interpreted according  
to the current &Qn setting as follows:

&Q0, &Q1, &Q4,

&Q5,  
&Q6  
DTR  
drop  
causes

the  
modem  
to  
perform  
a  
soft  
reset  
as  
of  
the  
Z  
command  
were  
received.  
The  
&Y  
setting  
determines  
which  
profile  
is  
loaded.

&Q2, &Q3 DTR  
drop causes the  
modem to  
hang-up.  
Auto-answer is  
inhibited.

&Dn has the following meaning for CH1786:

&D0 Modem ignores DTR (Default).

&D1 Modem assumes command state  
when ON-to-OFF transition is detected  
on DTR.

&D2 Modem hangs up, assumes command state and disables  
auto-answer upon detecting ON-to-OFF transition on DTR.

&D3 Modem assumes initialization state  
upon detecting an ON-to-OFF transition  
DTR.

### **&Fn - Restore Factory Configuration (Profile)**

The modem loads the factory default configuration (profile). The factory defaults are identified for each command and in the S-Register descriptions. A configuration (profile) consists of a subset of S-Registers.

&F Restore factory configuration 0.

&F1 Restore factory configuration 1.

Result Codes:

OK

ERROR If the modem is connected.

### **&Gn - Select Guard Tone**

The modem generates the guard tone selected by this command according to the parameter supplied (DPSK modulation modes only). The parameter value, if valid, is written to S23 bits 6 and 7.

&Go Disables guard tone. (Default.)

&G1 Disables guard tone. (Reserved in CH1786)

&G2 Selects 1800 Hz guard tone.

This command may not be permitted in some countries.

Result Codes:

OK n=0 to 2.

ERROR Otherwise.

### **&Jn - Telephone Jack Control**

This command is included only for compatibility and performs no function except to load the S-Register. The parameter value, if valid, is written S21 bit 0.

&J0 &J0 command. (Default.)

&J1 &J1 command.

Result Codes:

OK n=0 or 1.

ERROR Otherwise. P

### **&Kn - Flow Control (CH179X only)**

This command defines the DTE/DCE (terminal/modem) flow control mechanism. The parameter value, if valid, is written to S39 bits 0, 1, and 2.

&K0 Disables flow control.

&K3 Enables RTS/CTS flow control. (Default for data modem modes.)

&K4 Enables XON/XOFF flow control.

&K5 Enables transparent XON/XOFF flow control.

&K6 Enables both RTS/CTS and XON/XOFF flow control. (Default for fax modem and voice modes.)

Result Codes:

OK n=0, 3, 4, 5, or 6.

ERROR Otherwise.

### **&Mn - Asynchronous/Synchronous Mode Selection**

This command determines the DTR operating mode. The modem treats the &M command as a subset of the &Q command (CH1786 has only &M0).

&M0 Selects direct asynchronous operation. Note that the command sequence &M0\N0 selects normal buffered mode, but the command sequence \N0&M0 selects direct mode. This is because the \N0 command is analogous to the &Q6 command. The value 000b is written to S27 bits 3, 1, and 0, respectively. (See &Q).

&M1 (Not Supported) Selects synchronous connect mode with async off-line command mode. The value 001b

is written to S27 bits 3, 1 and 0, respectively. (Serial interface operation only.)

**&M2 (Not Supported)** Selects synchronous connect mode with async off-line command mode. Same as &M1 except that &M2 enables DTR dialing of directory slot 0. The modem will disconnect if DTR is OFF for more than the period in S25 (in units of hundredths of a second): the data connection will be synchronous. The value 010b is written to S27 bits 3, 1 and 0, respectively. (Serial interface operation only.)

**&M3 (Not Supported)** Selects synchronous connect mode. This mode allows DTR to act as talk/data switch. The call is manually initiated while DTR is inactive. When DTR becomes active, the handshake proceeds in originate or answer mode according to S14 bit 7. The value 011b is written to S27 bits 3, 1, and 0, respectively. (Serial interface operation only.)

Result Codes:

OK n=0 to 3.

ERROR Otherwise.

### **&Pn - Select Pulse Dial Make/Break Ratio**

This command determines the make/break ratio used during pulse dialing.

**&P0** Selects 39%-61% make/break ratio at 10 pulses per second. (Default.)

**&P1** Selects 33%-67% make/break ratio at 10 pulses per second.

**&P2** Selects 39%-61% make/break ratio at 20 pulses per second.

**&P3** Selects 33%-67% make/break ratio at 20 pulses per second.

Result Codes:

OK n=0 to 3.

ERROR Otherwise.

### **&Qn - Sync/Async Mode**

This command is an extension of the &M command and is used to control the connection modes permitted. It is used in conjunction with S36 and S48 for CH179X. (Also, see \N.)

**NOTE:** When the &Q0 to &Q4 command is issued to select the mode, the subsequent connect message will

report the DCE speed regardless of the W command and S95 settings (CH1786 has only &Q0).

&Q0 Selects direct asynchronous operation. The value 000b is written to S27 bits 3, 1, and 0, respectively. See &M0.

&Q1 &Q4 Not Supported.

&Q5 The modem will try to negotiate an error-corrected link. The modem can be configured using S36 to determine whether a failure will result in the modem returning on-hook or will result in fallback to an asynchronous connection. The value 101b is written to S27 bits 3, 1, and 0, respectively. (Default.)

&Q6 Selects asynchronous operation in normal mode (speed buffering). The value 110b is written to S27 bits 3, 1, and 0, respectively.

Result Codes:

OK n=0 to 6.

ERROR Otherwise.

#### **&Sn - DSR Override**

This command selects how the modem will control DSR. The parameter value, if valid, is written to S21 bit 6.

&S0 DSR will remain ON at all times. (Default.)

&S1 DSR will become active after answer tone has been detected and inactive after the carrier has been lost.

Result Codes:

OK n=0 or 1.

ERROR Otherwise.

#### **&Tn - Test and Diagnostics**

The modem will perform selected test and diagnostic functions according to the parameter supplied. A test can be run only when in an asynchronous operation in nonerror correction mode (normal or direct mode). To terminate a test in progress, the escape sequence must be entered first, except for parameters 7 and 8 (see Section 3.1.3). If S18 is nonzero, a test will terminate automatically after the time specified by S18 and display the OK message.

**NOTE:** For tests 3,6 and 7, a connection between the two modems must first be established.

&T0 Terminates test in progress. Clears S16.

&T1 Initiates local analog loopback, V.54 Loop 3. Sets S16 bit 0. If a connection exists when this command is issued, the modem hangs up. The CONNECT XXXX message is displayed upon the start of

the test.

&T2 Returns ERROR.

&T3 Initiates local digital loopback, V.54 Loop 2. Sets S16 bit 2. If no connection exists, ERROR is returned. Sets S16 bit 4 when the test is in progress.

&T4 Enables digital loopback acknowledgment for remote request, i.e., and RDL request from a remote modem is allowed. Sets S23 bit 0.

&T5 Disables digital loopback acknowledgment for remote request, i.e., and RDL request from a remote modem is denied. Clears S23 bit 0.

&T6 Requests a remote digital loopback (RDL), V.54 Loop 2, without self test. If no connection exists, ERROR is returned. Sets S16 bit 4 when the test is in progress. The CONNECT XXXX message is displayed upon the start of the test.

&T7 Requests a remote digital loopback (RDL), V54 Loop 2, without self test. (In self test, a test pattern is looped back and checked by the modem.) If no connection exists, ERROR is returned. When the test is terminated either via expiration of S18, or via the &T0 or H command, the number of detected errors is reported to the DTE. Sets S16 bit 5 when the test is in progress.

&T8 Initiates local analog loopback, V.54 Loop 3, with self test. (In self test, a test pattern is looped back and checked by the modem.) If a connection exists, the modem hangs up before the test is initiated.

When the test is terminated either via expiration of S18, or via the &T0 or H command, the number of detected errors is reported to the DTE. Sets S16 bit 6 when the test is in progress. This command may not be available in some countries due to PTT restrictions.

### **&V - Display Current Configuration and Stored Profiles**

Reports the current (active) configuration, the stored (user) profiles, and the first four stored telephone numbers. The stored profiles and telephone numbers are not displayed if the NVRAM is not installed or is not operational as detected by the NVRAM test during reset processing.

Result Code:

OK

Example:

AT&V

**ACTIVE PROFILE:**

B0 E1 L1 M1 N1 Q0 T V1 W0 X4 Y0 &C0 &D0 &G2 &J0 &K3 &Q5 &R1 &S0 &T4 &X0  
 &Y0 S00:002 S01: 000 S02:043 S03:013 S04:010 S05:008 S06:002 S07:030  
 S08:002 S09:006 S10:014 S11:255 S12:050 S18:000 S25:005 S26:001 S36:007  
 S37:000 S38:020 S46:138 S48:007 S95:000

**STORED PROFILE 0:**

B0 E1 L1 M1 N1 Q0 T V1 W0 X4 Y0 &C0 &D0 &G2 &J0 &K3 &Q5 &R1 &S0 &T5 &X0  
 S00:002 S02:043 S06:002 S07:030 S08:002 S09:006 S10:014 S11:095 S12:050  
 S18:000 S36:007 S37:000 S40:150 S41:003 S46:138 S95:000

**STORED PROFILE 1:**

B0 E1 L1 M1 N1 Q0 T V1 W0 X4 Y0 &C0 &D0 &G2 &J0 &K3 &Q5 &R1 &S0 &T5 &X0  
 S00:002 S02:043 S06:002 S07:030 S08:002 S09:006 S10:014 S11:095 S12:050  
 S18:000 S36:007 S37:000 S40:150 S41:003 S46:138 S95:000

**TELEPHONE NUMBERS:**

0= 1=

2= 3=

OK

**&Wn - Store Current Configuration**

Saves the current (active) configuration (profile), including S-Registers, in one of the two user profiles in NVRAM as denoted by the parameter value. This command will yield an ERROR message if the NVRAM is not installed or is not operational as detected by the NVRAM test.

The current configuration is comprised of a list of storable parameters illustrated in the &V command. These settings are restored to the active configuration upon receiving an Zn command or at power up (see &Yn command).

&W0 Store the current configuration as profile 0.

&W1 Store the current configuration as profile 1.

**Result Codes:**

OK n=0 or 1.

ERROR Otherwise.

**&Yn - Designate a fault Reset Profile**

Selects which user profile will be used after a hard reset.

&Y0 The modem will use profile 0.

&Y1 The modem will use profile 1.

**Result Codes:**

OK n=0 to 1.

ERROR If n>1, or if NVRAM is not installed or is not operational.



**&Zn=x - Store Telephone Number**

The modem can store up to four telephone numbers and each telephone number dial string can contain up to 34 digits.

&Zn=x n=0 to 3 and x=dial string.  
(Requires 256-byte NVRAM.)

Result Codes:

OK For n < 3, and x < 34 digits.

ERROR If n>3, x>35 digits, or if NVRAM  
is not installed or is not operational.

**C) AT% COMMANDS****%C - Enable/Disable Data Compression**

Enables or disables data compression negotiation . The modem can only perform data compression on an error corrected link. The parameter value, if valid, is written to S41 bits 0 and 1.

%C0 Disables data compression. Resets  
S46 bit 1.

%C1 Enables MNP 5 data  
compression negotiation.  
Resets S46 bit 1.

%C2 Enables V.42 bits data  
compression. Sets S46 bit 1.

%C3 Enables both V.42 bits and MNP5  
data compression.  
Sets S46 bit 1. (Default)

Result Codes:

OK n=0, 1, 2 or 3

ERROR Otherwise.

**%En - Enable/Disable Line Quality Monitor and Auto-Retrain or Fallback/Fall Forward CH179X only)**

Controls whether or not the modem will automatically monitor the line quality and request a retrain (%E1) or fall back when line quality is insufficient or fall forward when line quality is sufficient (%E2). The parameter value, if valid, is written to S41 bits 2 and 6.

If enabled, the modem attempts to retrain for a maximum of 30 seconds.

%E0 Disable line quality monitor and  
auto-retrain.

%E1 Enable line quality monitor and  
auto-retrain.

%E2 Enable line quality monitor and  
fallback/fall forward. (Default)

Result Codes:

OK n=0, 1, or 2.

ERROR Otherwise

**Fallback/Fall Forward.**

When %E2 is active, the modem monitors the line quality (EQM). When line quality is insufficient, the modem will initiate a rate renegotiation to a lower speed within The V.34/V.FC/ V.32 bis/V.32 (RC288) or V.32 bis/V.32 (RC144) modulation speeds. The modem will keep falling back within the current modulation if necessary until the speed reaches 2400 bps (V.34), 14400 bps (V>FC). Or 4800 bps (V.32). Below this rate, the modem will only do retrains if EQM thresholds are exceeded. If the EQM is sufficient for at least one minute, the modem will initiate a rate renegotiation to a higher speed within the current modulation speeds. The rate renegotiations will be done without a retrain if a V.32 bis connection is established.

Speeds attempted during fallback/fall forward are those shown to be available in the rate sequences exchanged during the initial connection. Fallback/fall forward is available in error correction and normal modes, but not in direct mode or synchronous mode with external clocks.

**%L - Line Signal Level (CH179X only)**

Returns a value which indicates the received signal level. The value returned is a direct indication of the receive level at the MDP, not at the telephone line connector. For example, 009= -9 dB, 043= -43dBm, and so on.

Result Codes:

OK

**%Q - Line Signal Quality (CH179X only)**

Reports the line signal quality. Returns the higher order byte of the EQM value. Based on the EQM value, retrain or fallback/fall forward may be initiated if enabled by %E1 or %E2.

Example:

AT%Q

015

Result Codes:

OK If connected.

ERROR If not connected, or connected in 300 bps, V.23, or fax modes.

**D) AT\ AND - COMMANDS (CH179X only)****\An - Select Maximum MNP Block Size**

The modem will operate an MNP error corrected link using a maximum block size controlled by the parameter supplied. The parameter value, if valid, is written to S40 bits 6 and 7.

\A0 64 characters.

\A1 128 characters. (Default.)

\A2 192 characters.

\A3 256 characters.

Result Codes:

OK n=0 to 3.

ERROR Otherwise.

**\Bn - Transmit Break to Remote**

In nonerror correction mode, the modem will transmit a break signal to the remote modem with a length in multiples of 100 ms according to parameter specified. If a number in excess of 9 is entered, 9 is used. The

command works in conjunction with the \K command.

In error correction mode, the modem will signal a break through the active error correction protocol, giving no indication of the length .

\B1-\B9 Break length in 100 ms units.  
(Default = 3.) (Nonerror corrected mode only.)

Result Codes:

OK If connected in data modem mode.

NO CARRIER If not connected or  
connected in fax modem mode.

**Note:** When the modem receives a break from the remote modem, break is passed to the DTE as follows: In nonerror correction mode direct the break length is passed; in nonerror correction mode normal and in error correction mode, a 300 ms break is passed.

### \Kn - Break Control

Controls the response of the modem to a break received from the DTE or the remote modem or the \B command according to the parameter supplied. The parameter value, if valid, is written to S40 bits 3, 4, and 5.

The response is different in three separate states.

The first state is where the modem receives a break from the DTE when the modem is operating in data transfer mode:

\K0 Enter on-line command mode, no  
break sent to the remote modem.

\K1 Clear data buffers and send break to  
remote modem.

\K2 Same as 0.

\K3 Send break to remote modem  
immediately.

\K4 Same as 0.

\K5 Send break to remote modem in  
sequence with transmitted data.  
(Default.)

The second case is where the modem is in the on-line command state (waiting for AT commands) during a data connection, and the \B is received in order to send a break to the remote modem:

\K0 Clear data buffers and send break to  
remote modem.

\K1 Clear data buffers and send break to  
remote modem. (Same as 0.)

\K2 Send break to remote modem  
immediately.

\K3 Send break to remote modem  
immediately. (Same as 2.)

\K4 Send break to remote modem in  
sequence with data.

\K5 Send break to remote modem in

sequence with data. (Same as 4.)  
(Default.)

The third case is where a break is received from a remote modem during a non-error corrected connection:

\K0 Clears data buffers and sends break to the DTE.

\K1 Clears data buffers and sends break to the DTE. (Same as 0.)

\K2 Send a break immediately to DTE.

\K3 Send a break immediately to DTE.  
(Same as 2.)

\K4 Send a break in sequence with received data to DTE.

\K5 Send a break in sequence with received data to DTE. (Same as 4.)  
(Default.)

Result Codes:

OK n=0 to 5.

ERROR Otherwise.

### **\Nn - Operating Mode**

This command controls the preferred error correcting mode to be negotiated in a subsequent data connection. This command is affected by the OEM firmware configuration.

\No Selects normal speed buffered mode  
(disables error-correction mode.)  
(Forces &Q6.)

\N1 Serial interface selected - Selects direct mode and is equivalent to &M0, &Q0 mode of operation. (Forces &Q0.)

\N2 Selects reliable (error-correction) mode. The modem will first attempt a LAPM connection and then an MNP connection. Failure to make a reliable connection results in the modem hanging up. (Forces &Q5, S36=4, and S48=7.)

\N3 Selects auto reliable mode. This operates the same as \N2 except failure to make a reliable connection results in the modem falling back to the speed buffered normal mode. (Forces &Q5, S36=7, and S48=7)

\N4 Selects LAPM error-correction mode. Failure to make an LAPM error-correction connection results in the modem hanging up. (Forces &Q5 and S48=0.) Note: The -K1 command can override the \N4 command.

\N5 Selects MNP error-correction mode. Failure to make an MNP error-correction

connection results in the modem hanging up. (Forces &Q5, S36=4, and S48=128.)

#### Result Codes:

OK n=0 to 5.

ERROR Otherwise.

### **\Vn - Single Line Connect Message Enable**

The single line connect message format can be enabled or disabled by the \Vn command as follows:

\V0 Connect messages are controlled by the command settings X, W, and S95.

\V1 Connect messages are displayed in the single line format described below subject to the command settings V (Verbose) and Q (Quiet). In

Non-Verbose mode (V0), single line connect messages are disabled and a single numeric result code is generated for CONNECT DTE.

When single line connect messages are enabled, there are no CARRIER, PROTOCOL, or COMPRESSION messages apart from the fields described below.

The single line connect message format is:

```
CONNECT<DTE
Speed></Modulation></Protocol></Compression></Line
Speed>
```

Where:

>DTE speed =  
DTE speed, e.g.,  
57600.

Modulation =  
AV32" for V.32 or  
V.32 bis  
modulations.

AVFC@ for V.FCTM  
modulations.

AV34" for V.34  
modulations.

Note: Modulation  
is omitted for all  
other modulations.

Protocol =  
ANONE@ for no  
protocol.

AALT@ for  
Microcom Network  
Protocol.

ALAPM@ for  
LAP-M protocol.

Compression =  
ACCLASS5" for  
Microcom MNP5  
compression.

AV42BIS@ for  
V.42bis  
compression.

Note:  
Compression is  
omitted if protocol  
is NONE.

Line Speed = Asymmetric rates are displayed as /rate:TX/rate:RX, e.g.,/1200 TX/75 RX.

Symmetric rates  
are displayed as a  
single DCE rate,  
e.g., 14400.

### **-Kn-MNP Extended Services**

Enables or disables conversion of a V.42 LAPM connection to an MNP 10 connection. The parameter value, if valid, is written to S40 bits 0 and 1.

-K0 Disables V.42 LAPM to MNP 10  
conversion (Default).

-K1 Enables V.42 LAPM to MNP 10  
conversion.

-K2 Enables V.42 LAPM to MNP 10  
conversion; inhibits MNP Extended  
Services initiation during V.42 LAPM  
answer mode detection phase.

### **E) AT+Commands (CH179X only)**

#### **+MS - Select Modulation (see pages 23-26)**

This extended-format command selects the modulation, optionally enables or disables .automode, and optionally specifies the lowest and highest connection rates using one to four subparameters. The command format is:

+MS= <mod> [, [<automode>] [, [<max\_rate> ]]] <CR>

#### **Notes:**

1. For 14400 bps and lower speeds, the Nn command and S37 register can alternatively be used, in which case the +MS subparameters will modified to reflect the Nn and S37=x settings. Use of the Nn and S37=x commands is not recommended but is provided for compatibility with existing communication software. (S37 is not updated by the +MS command.)
2. Subparameters not entered (enter a comma only or <CR> to skip the last sub- parameter) remain at their current values.

### Reporting Selected Options

The modem can send a string of information to the DTE consisting of selected options using the following command:

+MS?

The response is:

+MS:  
<mod>,<automode>,<min\_rate>,<max\_rate>

For example:

+MS: 11,1,300,28800 (shows default values) [CH1798]

+MS: 10,1,300,14400 (shows default values) [CH1794]]

### Reporting Supported Options

The modem can send a string of information to the DTE consisting of selected options using the following command:

+MS=?

The response is:

+MS: (list of supported <mod> values), (list of supported <automode> values), (list of supported <min\_rate> values), (list of supported <max\_rate> values)

For example:

+MS: (0, 1, 2, 3, 9, 10, 11, 64, 69, 74), (0, 1), (300-28800) [CH1798]

+MS: (0, 1, 2, 3, 9, 10, 64, 69), (0, 1), (300-14400), [CH1794]

### Subparameter Definitions

1. <mod> = A decimal number which specifies the preferred modulation (automode enabled) or the modulation (automode disabled) to use in originating or answering a connection. The options are:

<mod>	Modulation	Possible Rates (bps) 1.	Notes
0	V.21	300	
1	V.22	1200	
2	V.22 bis	2400 or 1200	
3	V.23	1200	See Note 2
9	V.32	9600 or 4800	
10	V.32 bis	14400, 12000, 9600, 7200 or 4800	Default [CH1794]
11	V.34	28800, 06400, 24000, 21600, 19200, 16800, 14400, 12000, 9600, 7200, 4800 or 2400	Default [CH1798] [CH1798 only]
64	Bell 103	300	
69	Bell 212	1200	
74	V.34	28800, 26400, 24000, 21600, 19200, 16800, or 14400	[CH1798 only]
<b>Notes:</b>			

1. See optional <automode>, <min\_rate>, and <max\_rate> subparameters.

For V.23, originating modes transmit at 75 bps and receive at 1200 bps; answering modes transmit at 1200 bps and receive at 75 bps. The rate is always specified as 1200 bps.

The modem may also automatically switch to another modulation (automode), subject to the following constraints:

- a. The modem may not be able to automatically switch from the current modulation (specified by <mod>) to some other modulation. For example, there is no standard way to automode from Bell 103 to V.23.
- b. The DTE may disable automode operation (see <automode> below).
- c. The DTE may constrain the range of modulations available by specifying the lowest and highest rates (see <min\_rate> and <max\_rate> below).

2. <automode> is an optional numeric value which enables or disables automatic modulation negotiation using V.8 or V.32 bis Annex A. The options are:

<automode>	Option Selected	Notes
0	Automode disabled	
1	Automode enabled using V.8 or V.32 Annex A	Default

The default value is 1, which enables automode. Note, however, there are modulations for which there is no automatic negotiation, e.g., Bell 212 (<mod> = 69).

**For <automode> = 0 (automode disabled, i.e., fixed modulation):**

- a. If <max\_rate> is within the rates supported by the selected modulation, the selected rate is that specified by <max\_rate>. For example:

+MS=10,0,2400,14400 selects V.32 bis 4800 bps fixed rate.

- b. If <max\_rate> is greater than the highest speed supported by the modulation specified by <mod>, the starting rate is the highest rate supported by the selected modulation. For example:

+MS=10,0,2400,14400 selects V.32 bis 14400,14000,9600,7200, or 4800 bps.

- c. To emulate issuance of the NOS37=x command sequence to select fixed mode operation, specify the <max\_rate> and <min\_rate> both to be the (same) requested speed, and <mod> to be the modulation for that speed. For example:

+MS=11,0,16800,16800 selects V.34 16800 bps fixed mode  
(no comparable S37 command).

+MS=10,0,12000,12000 selects V.32 bis 12000 bps fixed mode (same as /NOS37=10).

**For <automode> = 1 (automode enabled, i.e., automatically selected speed and modulation):**

The modem connects at the highest possible rate in accordance with V.8, or V.32 bis Annex A if V.8 is not supported by the remote modem.

- a. If <max\_rate> is greater than the highest rate supported by the modulation



specified by <mod>, the modem automodes down from the highest rate of the selected modulation. For example:

+MS=10,1,1200,2400 selects automode starting from V.32 bis 14400 bps.

b. To emulate issuance of the N1S37=x sequence command, specify the modulation and the rate to start automoding down from using <mod> and <max\_rate>, respectively. Set min\_rate> to 300 to allow automoding all the way down to V.21 300 bps. For example:

+MS=11,1,300,16800 selects automode starting at V.34 16800 bps (no comparable S37 command).

+MS=9,1,300,12000 selects automode starting at V 32 bis 12000 bps (same as N1S37=10).

3. <min\_rate> is an optional number which specifies the lowest rate at which the modem may establish a connection. The value is decimal coded, in units of bps, e.g., 2400 specifies the lowest rate to be 2400 bps. The default is 300 for 300 bps.

<max\_rate> is an optional number which specifies the highest rate at which the modem may establish a connection. The value is decimal coded, in units of bps, e.g., 14400 specifies the highest rate to be 14400 bps. The default is 28800 for 28800 bps.

#### **F) MODEMS WITH FAX OPTION:**

+FCLASS=n Select Service Class. +FCLASS=n command sets the active service class.

+FCLASS=0 Return to data mode

+FCLASS=1 Fax Class 1

+FCLASS=2 Fax Class 2 (CH179X only)

+FCLASS=3 Fax Class 3 (Not supported)

**For additional FAX commands, see Application Note 144.**

#### **G) AT COMMAND RESULT CODES**

The modem responds to commands from the DTE and to activity on the line by signaling to the DTE in the form of result codes. The result codes that the modem can send are described below.

Two forms of each result code are available: long-form, and English-like Averbos@ response, and short-form, a data-like numeric response (included in parentheses following the long-form). The long-form code is preceded and terminated by the sequence < CR> < LF>. The short-form is terminated by < CR>, only with no preceding sequence.

If result messages are suppressed, nothing is returned to the DTE. The long-form results codes can be modified by the OEM through the ConfigurACE Configuration Utility Program. (See ConfigurACE description.)

#### **OK (0)**

The OK code is returned by the modem to acknowledge execution of a command line.

#### **CONNECT (1)**

The modem will send this result code upon connection when:

1. The line speed is 300 bps and the modem has been instructed to report the line speed to the DTE upon connecting, or
2. The DTE speed is 300 bps and the modem has been instructed to report the DTE speed to the DTE upon connection, or
3. The range of result code responses is restricted by the X command such that no speed reporting is allowed.

**RING (2)**

The modem sends this result code when incoming ringing is detected on the line.

When cellular interface is selected, RING indicates that the cellular phone is receiving an incoming call.

**NO CARRIER (3)**

The modem sends this result code when attempting to establish a call if:

1. Ringback is detected and later ceases but no carrier is detected within the period of time determined by register S7, or
2. No ringback is detected within the period of time determined by register S7. This result code is also used when the modem auto-disconnects due to loss of carrier.

Under X0, if busy tone detection is enforced, this result code is used as a response to the detection of busy or circuit busy. Under X0, if dial tone detection is enforced or selected, this result code is used to indicate that dial tone has not been detected.

**ERROR (4)**

The modem returns this result code if the command line contains a syntax error or it is unable to execute a command contained in the command line. It is issued if a command does not exist or if the parameter supplied is outside the permitted range.

Under X0, X1, X2, and X3, this result is used instead of DELAYED and BLACKLISTED.

**CONNECT 1200 (5)**

For X1, X2, X3, and X4, the modem sends this result code when:

1. The line speed is 1200 bps and the modem has been instructed to report the line speed to the DTE upon connecting, or
2. The DTE speed is 1200 bps and the modem has been instructed to report the DTE speed to the DTE upon connecting. (Also, see the W command.),

**NO DIAL TONE (6)**

For X2 and X4, the modem sends this result code if it has been instructed to wait for dial tone during dialing but none is received. When cellular phone interface is selected, NO DIALTONE indicates that cellular service is not currently available.

**BUSY (7)**

For X3 and X4, if busy tone detection is enforced, the modem sends this result code when attempting to originate a call if the busy (engaged) signal is detected on the line.

**NO ANSWER (8)**

The modem sends this result code when attempting to originate a call if a continuous ring-back signal is detected on the line until the expiration of the timer S7.

**CONNECT 0600 (9)**

For X1, X2, X3, and X4, the modem sends this result code when:

1. The line speed is 600 bps and the modem has been instructed to report the line speed to the DTE upon connecting, or
2. The DTE speed is 600 bps and the modem has been instructed to report the DTE speed to the DTE upon connecting.

**CONNECT 2400 (10)**

For X1, X2, X3, and X4, the modem sends this result code when:

1. The line speed is 2400 bps and the modem has been instructed to report the line speed to the DTE upon connecting, or
2. The DTE speed is 2400 bps and the modem has been instructed to report the DTE speed to the DTE upon connecting.

**CONNECT 4800 (11)**

For X1, X2, X3, and X4, the modem sends this result code when:

1. The line speed is 4800 bps and the modem has been instructed to report the line speed to the DTE upon connecting, or
2. The DTE speed is 4800 bps and the modem has been instructed to report the DTE speed to the DTE upon connecting.

**CONNECT 9600 (12)**

For X1, X2, X3, and X4, the modem sends this result code when:

1. The line speed is 9600 bps and the modem has been instructed to report the line speed to the DTE upon connecting, or
2. The DTE speed is 9600 bps and the modem has been instructed to report the DTE speed to the DTE upon connecting.

**CONNECT 7200 (13)**

For X1, X2, X3, and X4, the modem sends this result code when:

1. The line speed is 7200 bps and the modem has been instructed to report the line speed to the DTE upon connecting, or
2. The DTE speed is 7200 bps and the modem has been instructed to report the DTE speed to the DTE upon connecting.

**CONNECT 12000 (14)**

For X1, X2, X3, and X4, the modem sends this result code when:

1. The line speed is 12000 bps and the modem has been instructed to report the line speed to the DTE upon connecting, or
2. The DTE speed is 12000 bps and the modem has been instructed to report the DTE speed to the DTE upon connecting.

**CONNECT 14400 (15)**

For X1, X2, X3, and X4, the modem sends this result code when:

1. The line speed is 14400 bps and the modem has been instructed to report the line speed to the DTE upon connecting, or
2. The DTE speed is 14400 bps and the modem has been instructed to report the DTE speed to the DTE upon connecting.

**CONNECT 19200 (16)**

For X1, X2, X3, and X4, the modem sends this result code when:

1. The line speed is 19200 bps and the modem has been instructed to report the line speed to the DTE upon connecting, or
2. The DTE speed is 19200 bps and the modem has been instructed to report the DTE speed to the DTE upon connecting.

**CARRIER 7200 (49)**

The modem sends this result code when a 7200 bps data rate has been detected on the line and carrier reporting has been enabled. (See S95 and Xn.)

**CARRIER 9600 (50)**

The modem sends this result code when a 9600 bps data rate has been detected on the line and carrier reporting has been enabled. (See S95 and Xn.)

**CARRIER 12000 (51)**

The modem sends this result code when a 12000 bps data rate has been detected on the line and carrier reporting has been enabled. (See S95 and Xn.)

**CARRIER 14400 (52)**

The modem sends this result code when a 14400 bps data rate has been detected on the line and carrier reporting has been enabled. (See S95 and Xn.)

**CARRIER 16800 (53)**

The modem sends this result code when a 16800 bps data rate has been detected on the line and carrier reporting has been enabled. (See S95 and Xn.)

**CARRIER 19200 (54)**

The modem sends this result code when a 19200 bps data rate has been detected on the line and carrier reporting has been enabled. (See S95 and Xn.)

**CARRIER 21600 (55)**

The modem sends this result code when a 21600 bps data rate has been detected on the line and carrier reporting has been enabled. (See S95 and Xn.)

**CARRIER 24000 (56)**

The modem sends this result code when a 24000 bps data rate has been detected on the line and carrier reporting has been enabled. (See S95 and Xn.)

**CARRIER 26400 (57)**

The modem sends this result code when a 26400 bps data rate has been detected on the line and carrier reporting has been enabled. (See S95 and Xn.)

**CARRIER 28800 (58)**

The modem sends this result code when a 28800 bps data rate has been detected on the line and carrier reporting has been enabled. (See S95 and Xn.)

**CARRIER 16800 (59)**

The modem sends this result code when a 16800 bps data rate has been detected on the line and carrier reporting has been enabled. (See S95 and Xn.)

**CARRIER 21600 (61)**

The modem sends this result code when a 21600 bps data rate has been detected on the line and carrier reporting has been enabled. (See S95 and Xn.)

**CARRIER 24000 (62)**

The modem sends this result code when a 24000 bps data rate has been detected on the line and carrier

reporting has been enabled. (See S95 and Xn.)

**CARRIER 26400 (63)**

The modem sends this result code when a 26400 bps data rate has been detected on the line and carrier reporting has been enabled. (See S95 and Xn.)

**CONNECT 28800 (64)**

The modem sends this result code when a 28800 bps data rate has been detected on the line and carrier reporting has been enabled. (See S95 and Xn.)

**COMPRESSION: CLASS 5 (66)**

This message is sent to the DTE when the modem has connected in MNP Class 5 and COMPRESSION message reporting has been enabled. (See S95 and Xn.)

**COMPRESSION: V.42 bis (67)**

This message is sent to the DTE when the modem has connected in V.42 bis and COMPRESSION message reporting has been enabled. (See S95 and Xn.)

**COMPRESSION: NONE (69)**

This message is sent to the DTE when the modem has connected without data compression and COMPRESSION message reporting has been enabled. (See S95 and Xn.)

**PROTOCOL: NONE (70)**

This message is sent to the DTE when the modem has connected without any form of error correction, and the PROTOCOL message reporting has been enabled. (See S95 and Xn.)

**PROTOCOL: LAPM (77)**

This message is sent to the DTE when the modem has connected in the V.42 LAPM mode of error correction, and PROTOCOL message reporting has been enabled. (See S95 and Xn.)

**PROTOCOL: ALT (80)**

This message is sent to the DTE when the modem has connected in the MNP mode of error correction, and PROTOCOL message reporting has been enabled. (See S95 and Xn.)

**CONNECT 33600 (84)**

The modem sends this result code when a 33600 bps data rate has been detected on the line and carrier reporting has been enabled. (See S95 and Xn.)

**CONNECT 31200 (91)**

The modem sends this result code when a 31200 bps data rate has been detected on the line and carrier reporting has been enabled. (See S95 and Xn.)

**CONNECT 32000 (150)**

The modem sends this result code when a 32000 bps data rate has been detected on the line and carrier reporting has been enabled. (See S95 and Xn.)

**H) S-REGISTERS**

The S-Registers are summarized in Table 2-1 and Table 2-2 along with their default values; registers denoted with and >\*= may be stored in one of the two user profiles by entering the &Wn command. One of these profiles may be loaded at any time by using the Zn command. Registers or register fields quoted as Areserved@ are reserved for current or future use by the firmware, or are permanently overridden by PTT limitations.

All bit-mapped registers are read-only. The appropriate AT command which controls the relevant bits in the S-Register should be used to change the value.

### FACTORY DEFAULTS (CH179X only)

The factory default values are stored in ROM and are loaded into the active configuration at power up or by the ATZn command. In addition, the designated default profile is subsequently loaded, and may change some of the factory default values. The designated default profile can be changed by entering the &Yn command where n is one of the two possible user profiles.

**Table 2-1 S-Register Summary for CH1798/94/99**

Register	Function	Range	Units	Saved	Default
S0	Rings to Auto-Answer	0-255	rings	*	0
S1	Ring Counter	0-255	rings		0
S2	Escape Character	0-255	ASCII	*	43
S3	Carriage Return Character	0-127	ASCII		13
S4	Line Feed Character	0-127	ASCII		10
S5	Backspace Character	0-255	ASCII		8
S6	Wait Time for Dial Tone	2-255	s		2
S7	Wait Time for Carrier	1-255	s		50
S8	Pause Time for Dial Delay Modifier	0-255	s	*	2
S9	Carrier Detect Response Time	1-255	0.1s	*	6
S10	Carrier Loss Disconnect Time	1-255	0.1s	*	14
S11	DTMF Tone Duration	50-255	0.001s	*	95
S12	Escape Prompt Delay	0-255	0.02s	*	50
S13	Reserved	-	-		-
S14	General Bit Mapped Options Status	-	-	*	138 (
S15	Reserved	-	-		-
S16	Test Mode Bit Mapped Options Status (&T)	-	-		0
S17	Reserved	-	-		-
S18	Test Timer	0-255	s	*	0
S19	AutoSync Options	-	-		0
S20	AutoSync HDLC Address or BSC Sync Characters	-255	-	*	0
S21	V.24/General Bit Mapped Options Status	-	-	*	52 (3
S22	Speaker/Results Bit Mapped Options Status	-	-	*	117 (
S23	General Bit Mapped Options Status		-	*	62 (3
S24	Sleep Inactivity Timer	0-255	s	*	0
S25	Delay to DTR Off	0-255	s or 0.01s		5
S26	RTS-to-CTS Delay	0-255	0.01s		1
S27	General Bit Mapped Options Status	-	-	*	73 (4
S28	General Bit Mapped Options Status	-	-	*	0
S30	Disconnect Inactivity Timer	0-255	10s		0

Register	Function	Range	Units	Saved	Default
S31	General Bit Mapped Options Status	-	-	*	194 (C2)
S32	XON Character	0-255	ASCII		17 (11h)
S33	XOFF Character	0-255	ASCII		19 (13h)
S34-S35	Reserved	-	-		-
S36	LAPM Failure Control	-	-	*	7
S37	Line Connection Speed	-	-	*	0

S38	Delay before Forced Hangup	0-255	s		20
S39	Flow Control Bit Mapped Options Status	-	-	*	3
S40	General Bit Mapped Options Status	-	-	*	104 (68h)
S41	General Bit Mapped Options Status	-	-	*	195 (C3h)
S42-S45	Reserved	-	-		-
S46	Data Compression Control	-	-	*	138
S48	V.42 Negotiation Control	-	-	*	7
S82	LAPM Break Control	-	-		128 (80h)
S86	Call Failure Reason Code	0-255	-		-
S95	Result Code Messages Control	-	-	*	0

\* Register value may be stored in one of two user profiles with the &W command.

\*\* Default values may be modified using ConfigurACE.

**Table 2-2 S-Registered Summary for CH1786**

Register	Range	Units	Default	Description
S0*	0-255	rings	00	Ring to Answer On
S1	0-255	rings	00	Ring Count
S2	0-127	ASCII	43	Escape Code Character
S3	0-127	ASCII	13	Carriage Return Character
S4	0-127	ASCII	10	Line Feed Character
S5	0-32, 127	ASCII	08	Back Space Character
S6	2-255	seconds	02	Wait for Dial Tone
S7	1-255	seconds	30	Wait Time For Data Carrier
S8	0-255	seconds	02	Pause Time for Comma
S9	1-255	1/10 seconds	06	Carrier Detect Response Time
S10	1-255	1/10 seconds	14	Lost Carrier to Hang-up Delay

Register	Range	Units	Default	Description
S11	50-255	ms	95	DTMF Dialing Speed
S12	0-255	1/50 seconds	50	Escape Code Guard Time
S14*	Bit Mapped	none	AA hex	Bit Mapped Options Register
S16	Bit Mapped	none	00	Modem Test Options
S18*	0-255	seconds	00	Test Timer
S21*	Bit Mapped	none	00	Bit Mapped Options Register
S22*	Bit Mapped	none	76 hex	Bit Mapped Options Register
S23*	Bit Mapped	none	07	Bit Mapped Options Register
S24	0-255	seconds	00	Sleep Mode Inactivity Timer
S25*	0-255	0.1 or 1 seconds	05	Delay to DTR
S26*	0-255	0.01 seconds	1	RTS to CTS Delay Interval
S27*	Bit Mapped	none	40 hex	Bit Mapped Options Register

\* Register value may be stored in one of two user profiles with the &W command.

## S-REGISTER DEFINITIONS

### S0 - Number of Rings to Auto-Answer

Sets the number of the rings required before the modem automatically answers a call. Setting this register to zero disables the auto-answer mode.

Range: 0-255 rings

Default: 0

### **S1 - Ring Counter**

S1 is incremented each time the modem detects a ring signal on the telephone line. S1 is cleared if no rings occur over an eight second interval.

Range: 0-255 rings

Default: 0

### **S2 - Escape Character**

S2 holds the decimal value of the ASCII character used as the escape character. The default value corresponds to ASCII >+=. A value over 127 disables the escape process, i.e., no escape character will be recognized.

Range: 0-255, ASCII decimal (0-127 for CH1786)

Default: 43 (+)

### **S3 - Carriage Return Character**

Sets the command line and result code terminator character. Pertains to asynchronous operation only.

Range: 0-127, ASCII decimal

Default: 13 (Carriage Return)

### **S4 - Line Feed Character**

Sets the character recognized as a line feed. Pertains to asynchronous operation only. The Line Feed control character is output after the Carriage Return control character if verbose result codes are used.

Range: 0-127, ASCII decimal

Default: 10 (Line Feed)

### **S5 - Backspace Character**

Sets the character recognized as a backspace. Pertains to asynchronous operation only. The modem will not recognize the Backspace character if it is set to a value that is greater than 32 ASCII. This character can be used to edit a command line. When the echo command is enabled, the modem echoes back to the local DTE the Backspace character, an ASCII space character and a second Backspace character; this means a total of three characters are transmitted each time the modem processes the Backspace character.

Range: 0-32, ASCII decimal (0-32, 127 for CH1786)

Default: 8 (Backspace)

### **S6 - Wait Time for Dial Tone Before Blind Dialing**

1. Sets the length of time, in seconds, that the modem will wait before starting to dial after going off-hook when blind dialing. This operation, however, may be affected by some ATX options according to country restrictions. The AWait for Dial Tone@ call process feature (W dial modifier in the dial string) will override the value in register S6.

The modem always pauses for a minimum of 2 seconds, even if the value of S6 is less than 2 seconds.

Range: 2-255 seconds

Default: 2

### **S7 - Wait Time For Carrier After Dial**



1. Sets the length of time, in seconds that the modem will wait for carrier before hanging up. The timer is started when the modem finished dialing (originate), or 2 seconds after going off-hook (answer). In originate mode, the timer is reset upon detection of answer tone if allowed by country restrictions.

### **S8 - Pause Time For Dial Delay**

Sets the time, in seconds, that the modem must pause when the A,@ dial modifier is encountered in the dial string.

Range: 0-255 seconds

Default: 2

### **S9 - Carrier Detect Response Time**

Sets the length of time, in tenths of a second, that the carrier must be present before the modem considers it valid and turns on RLSD. As this time is increased, there is less chance to detect a false carrier due to noise from the telephone line.

Range: 1-255 tenths of a second

Default: 6 (0.6 second)

### **S10 - Lost Carrier To Hang Up Delay**

Sets the length of time, in tenths of a second, that the modem waits before hanging up after a loss of character. This allows for a temporary carrier loss without causing the local modem to disconnect. When register S10 is set to 255, the modem functions as if a carrier is always present.

The actual interval the modem waits before disconnection is the value in register S10 minus the value in register S9. Therefore, the S10 value must be greater than the S9 value or else the modem disconnects before it recognizes the carrier.

Range: 1-255 tenths of a second

Default: 14 (1.4 seconds)

### **S11 - DTMF Tone Duration**

Sets the duration of tones in DTMF dialing (US models only). This value has no effect on pulse dialing.

For W-class models, this parameter is a country parameter loaded by ConfigurACE.

Range: 50-255 milliseconds

Default: 95 (95 milliseconds)

### **S12 - Escape Prompt Delay (EPD)**

Define the maximum period, in fiftieths of a second, allowed between receipt of the last character of the three escape character sequence from the DTE and sending of the OK result code to the DTE. If any characters are detected during this time, the OK will not be sent. Note that sending of the OK result code does not affect entry into command mode. (See 3.1.3.)

Range: 0-255 1/50 of a second

Default: 50 (1 second)

### **S13 - Reserved**

### **S14 - General Bit Mapped Options Status**

Indicates the status of command options.

Default: 138 (8Ah) (10001010b)

Bit 0 This bit is ignored.

Bit 1 Command echo (En)

0 = Disabled (E0)

1 = Enabled (E1) (Default)

Bit 2 Quiet mode (Qn)

0 = Send result codes (Q0) (Default)

1 = Do not send result codes (Q1)

Bit 3 Result codes (Vn)

0 = Numeric (V0)

1 = Verbose (V1) (Default)

Bit 4 Reserved

Bit 5 Tone (T)/Pulse(P)

0 = Tone (T) (Default)

1 = Pulse (P)

Bit 6 Reserved

Bit 7 Originate/Answer

0 = Answer

1 = Originate (Default)

#### **S15 - Reserved**

#### **S16 - General Bit Mapped Test Options Status**

Indicates the test in progress status.

Default: 0

Bit 0 Local analog loopback

0 = Disabled (Default)

1 = Enabled (&T1)

Bit 1 Not used

Bit 2 Local digital loopback

0 = Disabled (Default)

1 = Enabled (%T3)

Bit 3 Remote Digital loopback (RDL) status

0 = Modem not in RDL (Default)

1 = RDL in progress

Bit 4 RDL requested (AT%T6)

0 = RDL not requested (Default)

1 = RDL requested (&T6)

Bit 5 RDL with self test

0 = Disabled (Default)

1 = Enabled (&T7)

Bit 6 Local analog loopback (LAL) with self test

0 = Disabled (Default)

1 = Enabled (&T8)

Bit 7 Not used

### **S17 – Reserved**

### **S18 - Test Timer**

Sets the length of time, in seconds, that the modem conducts a test (commanded by &T7) before returning to the command mode. If this register value is zero, the test will not automatically terminate. The test must be terminated from the command mode by issuing an &T0 or H command. When S18 is nonzero, the modem returns the OK message upon test termination.

Range: 0-255 seconds

Default: 0

### **S19 - AutoSync Bit Mapped Options (CH1798/94 only) (Not Supported)**

Defines the options for AutoSync operation (see &Q4 command). S19 must be set to the desired value before &Q4 is issued.

Default: 0

Bit 0 Reserved

Bit 1 BS/HDL format select

0 = BS selected (Default)

1 = HDL selected

Bit 2 Address detection enable/disable

0 = Disabled (Default)

1 = Enabled

Bit 3 NAZI/NAZI coding select

0 = NAZI (Default)

1 = NAZI

Bit 4 Idle indicator select

0 = Mark idle (Default)

1 = Flag or sync idle

Bit 5-7 Reserved

### **S20 - AutoSync HDL Address or BS Sync Character (Not Supported)**

Defines the HDL address (S19 bit 1=1) or BS Sync Character (S19 bit 1=0) for AutoSync operation (see &Q4 command).

S20 must be set to the desired value before &Q4 is issued.

Range: 0-255

Default: 0

**S21 - V.24/General Bit Mapped Options Status**

Indicates the status of command options.

Default: 52 (34h) (00110100b)

Bit 0 Set by &Jn command but ignored otherwise

0 = &J0 (Default)

1 = &J1

Bit 1 Reserved

Bit 2 CTS behavior (&Rn)

0 = CTS tracks RTS (&R0) (not supported in CH1786)

1 = CTS always on (&R1) (Default)

Bits 3-4 DTR behavior (&Dn)

0 = &D0 selected (Default)

1 = &D1 selected

2 = &D2 selected

3 = &D3 selected

Bit 5 RLSD (DCD) behavior (&Cn)

0 = &C0 selected

1 = &C1 selected (Default)

Bit 6 DSR behavior (&Sn)

0 = &S0 selected (Default)

1 = &S1 selected

Bit 7 Long space disconnected (Yn)

0 = Y0 (Default)

1 = Y1

**S22 - Speaker/Results Bit Mapped Options Status**

Indicates the status of command options.

Default: 117 (75h) (01110101b)

Bits 0-1 Speaker volume (Ln)

0 = Off (L0)

1 = Low (L1) (Default)

2 = Medium (L2)

3 = High (L3)

Bits 2-3 Speaker control (Mn)

0 = Disabled (M0)

1 = Off on carrier (M1) (Default)

2 = Always on (M2)

3 = On during handshake (M3)

Bits 4-6 Limit result codes (Xn)

0 = X0

4 = X1

5 = X2

6 = X3

7 = X4 (Default)

Bit 7 Reserved in CH1798/94. In CH1786, bit 7=0 corresponds to &P0; bit 7=1 corresponds to &P1.

### **S23 - General Bit Mapped Options Status**

Indicates the status of command options.

Default: 62 (3Dh) (00111110b)

Bit 0 Grant RDL

0 = RDL not allowed (&T5) (Default)

1 = RDL allowed (&T4)

Bits 1-3 DTE Rate

0 = 0-300 bps

1 = 600 bps (not supported in CH1786)

2 = 1200 bps

3 = 2400 bps (Default for CH1786)

4 = 4800 bps (CH1798/94 only)

5 = 9600 bps (CH1798/94 only)

6 = 19200 bps (CH1798/94 only)

7 = 38100 bps or higher (Default for CH1798/94)

Bits 4-5 Assumed DTE parity

0 = even (Default for CH1786)

1 = not used (space parity for CH1786)

2 = odd

3 = none (Default for CH1798/94)

Bits 6-7 Guard tone (&Gn)

0 = None (&G0) (Default)

1 = None (&G1) (Reserved in CH1786)

2 = 1800 Hz (&G2)

### **S24 - Sleep Inactivity Timer (CH1786 only)**

Sets the length of time in seconds, that the modem will operate in normal mode with no detected telephone line or DTE line activity before entering low-power sleep mode. The timer is reset upon any DTE

line or telephone line activity. If the S24 value is zero, neither DTE line nor telephone inactivity will cause the modem to enter the sleep mode.

Range: 0-255 seconds

Default: 0

### **S25 - Delay To DTR**

Sets the length of time that the modem will ignore DTR for taking the action specified by &Dn. Its units are in one hundredths of a second.

Range: 0-255 (1 second for synchronous modes 1; 0.01 second otherwise)

Default: 5

### **S26 - RTS to CTS Delay (CH179X only)**

Sets the time delay, in hundredths of a second, before the modem turns CTS ON after detecting and OFF-to-ON transition on RTS when &R0 is commanded. Pertains to synchronous operation only.

Range: 0-255 hundredths of a second

Default: 1

### **S27 - Bit Mapped Options Status**

Indicates the status of command options.

Default: 73 (49h) (01001001b); 40h for CH1786

Bits 0,1,3 Synchronous/asynchronous selection (&Mn/&Qn)

Note: CH1786 has only &M0 and &Q0

3 1 0

0 0 0 = &M0 or &Q0

0 0 1 = &M1 or &Q1

0 1 0 = &M2 or &Q2

0 1 1 = &M3 or &Q3

1 0 0 = &Q4

1 0 1 = &Q5 (Default)

1 1 1 = &Q6

Bit 2 Leased line control (&Ln)

0 = Dial up line (&L0) (Default)

Bits 4-5 Internal clock select (&Xn)

0 = Internal clock (&X0) (Default)

1 = External clock (&X1) (not supported in CH1786)

2 = Slave clock (&X2) (not supported in CH1786)

Bit 6 CCITT/Bell mode select (Bn)

0 = CCITT mode (B0)

1 = Bell mode (B1) (Default)

Bit 7 Reserved in CH1798/94. In CH1786, bit 7=0 corresponds to AT+FAA=0; bit 7=1 corresponds to

AT+FAA=1

### **S28 - Bit Mapped Options Status for CH179X. S28 not accessed by customers in CH1786**

Default: 0

Bits 0-1 Reserved

Bit 2 Reserved (always 0)

Bits 3-4 Pulse dialing (&Pn)

0 = 39%-61% make/break ratio at 10 pulses per second (&P0) (Default)

1 = 33%-67% make/break ratio at 10 pulses per second (&P1)

2 = 39%-61% make/break ratio at 20 pulses per second (&P2)

3 = 33%-67% make/break ratio at 20 pulses per second (&P3)

**Note: S30 - S95 are for CH1798/94 only**

### **S30 - Disconnect Inactivity Timer**

Sets the length of time, in tens of seconds, that the modem will stay on-line before disconnecting when no data is sent or received. In error-correction mode, any data transmitted or received will reset the timer. In other modes, any data transmitted will reset the timer. The timer is inoperative in synchronous mode.

Range: 0-255 tens of seconds (0-2550 seconds)

Default: 0 (disabled)

### **S31 - Bit Mapped Options Status**

Default: 194 (C2h) (11000010b)

Bit 0 Single line connect message enable/disable (\Vn)

0 = Messages controlled by S95. Wn and Vn (\V0) (Default)

1 = Single connect message (\V1)

Bit 1 Auto line speed detection (Nn)

0 = Disabled (N0)

1 = Enabled (N1) (Default)

Bits 2-3 Error correction progress messages (Wn)

0 = DTE speed only (W0) (Default)

1 = Full reporting (W1)

2 = DCE speed only (W2)

Bits 4-5 Caller ID (#CID)

0 = Caller ID disabled (#CID=0) (Default)

1 = Short (formatted) Caller ID enabled (#CID=1)

2 = Long (unformatted) Caller ID enabled (#CID=2)

Bits 6-7 Reserved (Default - 11b)

**S32 - XON Character**

Sets the value of the XON character

Range: 0-255, ASCII decimal

Default: 17 (11h)

**S33 - XOFF Character**

Sets the value of the XOFF character

Range: 0-255, ASCII decimal

Default: 19 (13h)

**S34-35 – Reserved****S36 - LAPM Failure Control**

Default: 7 (00000111b)

Bits 0-2 This value indicates what should happen upon a LAPM failure. These fallback options are initiated immediately upon connection if S48=128. If an invalid number is entered, the number is accepted into the register, but S36 will act as if the default value has been entered.

0 = Modem disconnects.

1 = Modem stays on-line and a Direct mode connection is established.

2 = Reserved

3 = Modem stays on-line and a Normal mode connection is established.

4 = An MNP connection is attempted and if it fails, the modem disconnects.

5 = An MNP connection is attempted,  
and if it fails a direct mode connection is  
established.

6 = Reserved

7 = An MNP connection is attempted and  
if it fails, a Normal mode connection is  
established. (Default)

Bits 3-7 Reserved

**S37 - Desired Line Connection Speed**

This register specifies the desired line connection speed.

**Notes:**

1. When the Nn command is issued or the S37 register value is modified, the +MS command sub-parameters are updated to reflect the speed and modulation specified by the S37 value (see +MS command). For example:

\*If N0 command is active, S37=10 updates the +MS command subparameters to reflect +MS=10,1,300,12000



\*If N1 command is active, S37=10 updates the +MS command subparameters to reflect +MS=10,0,12000,12000

1. S37 is not updated by the =MS command.
1. Use of the +MS command is recommended instead of the Nn and S37=x commands. Nn and S37=x commands are supported for compatibility with existing communication software.

Default: 0

Bits 0-4 Desired line connection speed. This is interlinked with the Fn command (CH1794). If an invalid Number is entered, the number is accepted into the register, but S37 will act as if the default value has been entered.

0 = Attempt automode connection. If N0 is active, connection is attempted at the most recently sensed DTE speed (+MS command settings are updated to the appropriate values.). If N1 is active, connection is attempted at the highest possible speed (+MS settings are updated to 11,1,300,2880 to reflect V.34, automode, 300 bps minimum speed, and 28800 bps maximum speed.). (Default)

1-3 = Attempt to connect at 300 bps. F1 command (CH1794).

4 = Reserved

5 = Attempt to connect at V.22 1200 bps. F4 command (CH1794)

6 = Attempt to connect at V.22 1200 bps. F5 command (CH1794)

7 = Attempt to connect at V.23

8 = Attempt to connect at V.32 bis/V.32 4800 bps. F6 command (CH1794)

9 = Attempt to connect at V.32 bis/V.32 9600 bps. F8 command (CH1794)

10 = Attempt to connect at V.32 bis 12000 bps. F9 command (CH1794)

11 = Attempt to connect at V.32 bis 14400 bps. F10 command (CH1794)

12 = Attempt to connect at V.32 bis 7200 bps. F7 command (CH1794)

Bits 5-7 Reserved

### **S38 - Delay Before Forced Hang Up**

This register specifies the delay between the modem's receipt of the H command to disconnect (or ON-to-OFF transition of DTR if the modem is programmed to follow the signal), and the disconnect operation. Applicable to error-correction connection only. This register can be used to ensure that data in the modem buffer is sent before the modem disconnects.

1. If S38 is set to a value between 0 and 254, the modem will wait that number of seconds for remote modem to acknowledge all data in the modem buffer before disconnecting. If time expires before all data is sent, the NO CARRIER result code will be issued to indicate that data has been lost. If all data is transmitted prior to time-out, the response to the H0 command will be OK.
2. If S38 is set to 255, the modem does not time-out and continues to attempt to deliver data in the buffer

until the connection is lost or the data is delivered.

Range: 0-255 seconds

Default: 20

### **S39 - Flow Control bit Mapped Options Status**

Default: 3 (00000011b)

Bits 0-2 Status of command options

0 = No flow control

3 = RTS/CTS (&K3) (Default)

4 = XON/XOFF (&K4)

5 = Transparent XON (&K5)

6 = Both methods (&K6)

Bits 3-7 Reserved

### **S40 General Bit Mapped Options Status**

Indicates the status of command options.

Default: 104 (68h) (01101000b)

Bits 0-1 MNP Extended Services (-Kn)

0 = Disable extended services (-K0) (Default)

1 = Enable extended services (-K1)

2 = Enable extended services (-K2)

Bit 2 Reserved

Bits 3-5 Break Handling (\Kn)

0 = \K0

1 = \K1

2 = \K2

3 = \K3

4 = \K4

5 = \K5 (Default)

Bits 6-7 MNP block size (\An)

0 = 64 chars (\A0)

1 = 128 chars (\A1) (Default)

2 = 192 chars (\A2)

3 = 256 chars (\A3)

### **S41 - General Bit Mapped Options Status**

Indicates the status of command options.

Default: 195 (C3h) (11000011b)

Bits 0-1 Compression selection (%Cn)

0 = Disabled (%C0)

1 = MNP 5 (%C1)

2 = V.42 bis (%C2)

3 = MNP 5 and V.42 bis (%C3) (Default)

Bits 2, 6 Auto retrain and fallback/fall forward (%En)

Bit 6 Bit2

0 0 = Retrain and fallback/fall forward disabled (%E0)

0 1 = Retrain enabled (%E1)

1 0 = Fallback/fall forward enabled (%E2) (Default)

Bit 3 Reserved

Bits 4-5 Reserved

Bit 7 Reserved

#### **S46 - Data Compression Control**

Controls selection of compression. The following actions are executed for the given values:

Range: 136 or 138

Default: 138

S46 = 136 Execute error correction protocol with no compression.

S46 = 138 Execute error correction protocol with compression. (Default)

#### **S48 - V.42 Negotiation Action**

The V.42 negotiation process determines the capabilities of the remote modem. However, when the capabilities of the remote modem are known and negotiation is unnecessary, this process can be bypassed if so desired.

Range: 0, 7, or 128. If an invalid number is entered, it is accepted into the S-Register, but S48 will act as if 128 has been entered.

Default: 7

S48=0 Disable negotiation; bypass the detection and negotiation phases; and proceed with LAPM.

S48=7 Enable negotiation. (Default)

S48=128 Disable negotiation; bypass the detection and negotiation phases; and proceed at once with the fallback action specified in S36. Can be used to force MNP.

#### **S82 - Break Handling Options**

S82 is for compatibility purposes only, changing this register will not have any effect.

#### **S86 - Call Failure Reason Code**

When the modem issues a NO CARRIER result code, a value is written to this S-Register to help determine

the reason for the failed connection. S86 records the first event that contributes to a NO CARRIER message. The cause codes are:

Range: 0, 4, 5, 9, 12, 13, or 14

Default:

S86=0 Normal disconnect, no error occurred.

S86=4 Loss of carrier.

S86=5 V.42 negotiation failed to detect an error-correction modem at the other end.

S86=9 The modems could not find a common protocol.

S86=12 Normal disconnect initiated by the remote modem.

S86=13 Remote modem does not respond after 10 retransmissions of the same message.

S86=14 Protocol violation.

### **S95 - Extended Result Codes**

The bits in this register can be set to override some of the Wn command options. A bit set to a 1 in this register will enable the corresponding result code regardless of the Wn setting.

Default: 0

Bit 0 CONNECT result code indicates DCE speed instead of DTE speed.

Bit 1 Append/ARQ to CONNECT XXXX result code in error-correction mode. (XXXX = rate)

Bit 2 Enable CARRIER XXXX result code (XXXX = rate). If a V.FC connection is established, /VFC is appended to the CARRIER XXXX message, e.g., CARRIER 28800/VFC; note that there is no short form for this message (CH1798).

Bit 3 Enable PROTOCOL XXXX result code (XXXX = protocol identifier).

Bit 4 Reserved

Bit 5 Enable COMPRESSION result code (XXXX = compression type; see).

Bit 6 Reserved

Bit 7 Reserved

## **I. COMMON CONFIGURATION SETUP STRINGS FOR 1794/17/98/1799**

This appendix describes setup strings to establish commonly used configurations.

1. Force V.42 bis data compression with LAP-M error correction.  
AT+N4%C2-K0
1. Force V.42 bis data compression with MNP error correction.  
AT+N5%C2
1. Force MNP 5 data compression with MNP error correction.  
AT+N5%C1
1. Auto negotiate data compression and error correction.  
AT&F (factory defaults) or AT+N3%C3

**Note:** In this mode, the modem prefers LAP-M over MNP 10, MNP 10 over MNP 4, and V 42 bis over MNP

5. If error correction is not negotiated, the modem will connect in normal mode.



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